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Trusted Boot: Verifying the Xen Launch

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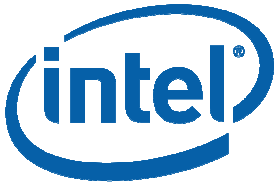

Fall 2007 Xen Summit

Agenda

- Intel® Trusted Execution Technology Overview
- What is Trusted Boot (tboot)?
- Why use Trusted Boot?
- Configuring Your System
- Creating and Provisioning Policies
- Tboot Support in Xen

Intel® Trusted Execution Technology (Intel® TXT)

Formerly called LT (LaGrande Technology)

Removes BIOS/bootloader/OS/etc. from trust chain

- Creates dynamic root of trust (DRTM)

HW-based measured and verified launch

- Does not require Intel® Virtualization Technology (Intel® VT)

Platform configuration protection

Reset memory protection

Safer Mode Extensions (SMX)

- Intel TXT processor instructions

Spec available:
http://www.intel.com/technology/security/

What is Trusted Boot (tboot)?

Open source, pre-kernel/VMM module

Uses Intel TXT to perform verified launch of OS kernel/VMM

- Today only supports Xen

Available from http://sourceforge.net/projects/tboot

- Mercurial repo at http://tboot.sourceforge.net/hg/tboot.hg
- Also tarballs of the source

Project also contains tools for policy creation and provisioning

- Intel TXT Launch Control Policy (LCP)
- Tboot Verified Launch policy

Why Use Trusted Boot?

Trusted Boot provides a foundation for a Trusted Xen

- Root of trust is in hardware: Intel TXT dynamic launch
- Tboot is verified by Intel TXT Launch Control Policy (LCP)
  - Part of measured launch
  - Can optionally verify BIOS
- Tboot Verified Launch verifies Xen and Dom0 (+ initrd)
  - Dom0 trust could be extended via IMA, disaggregation, etc.

Drop-in to Xen 3.2

- No changes to GRUB

  (Should be easily extensible to other bootloaders)
- No-op on non-TXT systems

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Configuring Your System

Xen 3.2 supports tboot

As of c/s 16267:26fb702fd8cf

1. Get tboot source and build

- Optional top-level Makefile targets: {build, install, clean}-tboot
  - Will download tboot.tar.gz from SourceForge

2. Get SINIT AC Module (`BRLK_SINIT_20070910_release.BIN`)

- From OEM or Trusted Boot SourceForge site (soon)

3. Edit grub.conf

```
title Xen 3.2 w/ Intel(R) Trusted Execution Technology
   root (hd0,1)
   kernel /tboot.gz
   module /xen.gz no-real-mode dom0_mem=524288 com1=115200,8n1
   module /vmlinuz-2.6.18-xen root=/dev/hda1 ro
   module /initrd-2.6.18-xen.img
   module /BRLK_SINIT_20070910_release.BIN
```

4. Boot

- Monitor the serial output for tboot progress

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Policies

Intel TXT LCP:

- Two types of policies: SRTM (BIOS) and MLE (tboot)
  - SRTM policy is optional; based on PCRs
- MLE policy is (list of) SHA-1 hash(es)
  - Optional SINIT revocation version
- Policy stored in TPM NV
  - Multiple hashes require separate file (whose hash is in TPM NV)

Tboot Verified Launch policy:

- Currently two components verified: hypervisor and Dom0
  - Will generalize in future
- Policies are (list of) SHA-1 hash(es) and policy type
  - Policy type determines behavior when errors are encountered:
    - Continue for all non-fatal errors
    - Halt except for verification failures
    - Halt for all errors
- Policies stored in TPM NV

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Preparing the TPM

Only need to do these once

Take ownership of the TPM:

1. `modprobe tpm_tis`
2. `tcsd`
3. `tpm_takeownership`
   - Choose password for TPM (ownerauth) and for SRK, confirming each

Define tboot error TPM NV index:

1. `lcptools/tpmnv_defindex -i 0x20000002 -s 8 -pv 0 -rl 0x07 -wl 0x07 -p <ownerauth>`

Define policy TPM NV indices:

1. `lcptools/tpmnv_defindex -i owner -p <ownerauth>`
2. `lcptools/tpmnv_defindex -i 0x20000001 -s 512 -pv 0x02 -p <ownerauth>`

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Creating Policies

Create LCP policy:

1. `lcptools/lcp_mlehash /boot/tboot.gz > mle_hash`
2. `lcptools/lcp_crtpol -t hashonly -m mle_hash -o lcp.pol`

Create Verified Launch policy:

1. `tb_polgen/tb_polgen –-create --policy_type nonfatal --uuid vmm --hash_type hash --file tcb.pol --cmdline “/xen.gz no-real-mode dom0_mem=524288 com1=115200,8n1” /boot/xen.gz`
2. `tb_polgen/tb_polgen --create --uuid dom0 --hash_type hash --file tcb.pol --cmdline “/vmlinuz-2.6.18-xen root=/dev/hda1 ro” /boot/vmlinuz-2.6.18-xen /boot/initrd-2.6.18-xen.img`

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Provisioning Policies

Write LCP and Verified Launch policies to TPM:

```
(modprobe tpm_tis; tcsd;)
1. lcptools/lcp_writepol -i owner -f lcp.pol
   -p <ownerauth>
2. lcptools/lcp_writepol -i 0x20000001
   -f tcb.pol -p <ownerauth>
```


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Tboot Support in Xen

"Discovery" of tboot shared page

- Passed as '`tboot=0x<phys_addr>`' command line option
- Contains tboot log addr, Sx data and trampoline/return addrs

Support E820_UNUSABLE memory type as reserving memory from Dom0

- Used by tboot to restrict Dom0 access to TXT data areas
- Eventually to protect tboot

Sx return into tboot for shutdown

- S3/4/5 w/o GETSEC[SEXIT] will hang/reboot system, so must call back into tboot to cleanup and shutdown

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